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Revision of the Bermuda Ferns.

BY BENJAMIN D. GILBERT.

The two chief authorities on Bermuda ferns are Governor J. H. Lefroy, whose list of Bermuda plants was published by The Smithsonian Institute in its Bulletin No. 25, in 1884; and the botanical volume of The Challenger Expedition, published by the British government in 1885, the material for which was collected between 1873 and 1877, and was determined by Mr. W. B. Hemsley. Another small volume, entitled "Plants of the Bermudas," by Oswald A. Reade, was also published at Hamilton, Bermuda, in 1885. It is very imperfect in its list of Filices, but is entitled to recognition on account of one species given in it, which neither of the other works mentions.

It should be remembered that the Bermudas are not tropical islands and that the fern flora is small in comparison with that of the West Indies. For instance, the ferns comprise more than one fifth of the flowering plants and vascular cryptogams growing in Jamaica, while in Bermuda they form only about one fourteenth part of the whole number. There is neither sufficient moisture nor sufficient heat to promote their growth. At the same time there are some very good and desirable species. Only one fern, however, is generally distributed throughout the islands: all the others being confined principally to two kinds of localities having distinct characteristics of their own. These localities are what are known, first, as "the marshes," and second, as "the caves."

The marshes are hardly what we would call swamps. They are large, level plats at the foot of hills or between them, where some

water collects in a rainy period, but which can always be traversed on foot except for a sluice way, perhaps eight to ten feet broad, which apparently has no current and no outlet, and which is often completely covered with duckweed (*Lemna minor*). On the margins of these dark sluggish waters grow large numbers of dog-bush (*Baccharis heterophylla*), while in the marshes themselves grow the omnipresent juniper, occasional large specimens of the palmetto (*Sabal Palmetto*), several species of Cyperaceous plants and quantities of ferns belonging to five or six species only.

There are two kinds of so-called "caves" in Bermuda. Several of them are genuine caves, and there the ferns grow, not inside the caves, but on the rocks and debris about their entrances. The other caves are simply holes in the earth, open to sun, air and rain, sometimes twelve to fifteen feet across at the top and as many feet deep ; sometimes 150 feet across and sixty to seventy-five feet deep. Geologists say that all these were once genuine caves, the roofs of which became too heavy to hold themselves up and fell into the interior, carrying with them whatever vegetation had grown on the surface. Darwin, in his "Voyage of a Naturalist," tells us that at the Galapagos Islands also "the tops of caverns have fallen in, leaving circular pits with steep sides." These caves are shady ; they retain moisture longer than the upper surface ; they are protected from the severe winds ; and as a consequence they are the haunts of the rarest and choicest ferns of the islands. The descent into these cavities is always steep, sometimes precipitous. They occur chiefly in what is known as "the Walsingham tract," a peninsula lying between Harrington sound on the west and Castle Harbor on the east, about three miles in length and one to two miles in width. It takes its name from the former residence of Tom Moore, the Irish poet, who was appointed to a government office in Bermuda and lived there for about six months, but was too fond of the gaities of London life to remain longer.

As there are only twenty-five species and varieties of ferns in Bermuda, I propose to speak of each separately and of the locality in which it grows.

#### ADIANTUM CAPILLUS-VENERIS L.

None of the authorities credit Bermuda with this species, but it will certainly have to be included, although probably naturalized

at a comparatively late date. The last day that I was out collecting in the Walsingham district I came across some fronds that looked quite different from the variety *A. Walsingense*, but I had seen so much of this fern that I supposed these plants were only another form of that variety and consequently gathered only two or three fronds. On returning to America and unpacking my collection, these fronds struck me at once as being larger and more open, with pinnae more deeply cut and more cuneate, than any other *Adiantum* in the collection. On consulting Governor Lefroy's list more carefully, it was found that *A. capillus-Veneris* was one of the ferns which he "planted out in promising localities about Paynter's Vale (Walsingham district) with a view to their introduction." In the case of this species his effort was evidently successful, and it may now be counted as one of the naturalized species of the island. Very likely it would have been found in other spots visited, if I had been on the look-out for it.

#### ADIANTUM BELLUM Moore.

Moore's description of this species was originally published in the Gardener's Chronicle, London, 1879. It was reproduced in the Voyage of H. M. S. Challenger, 1885, but as these publications are to be found only in a few of the larger libraries of this country, and the description is short, it is reprinted here.

"Fronds tufted, 3 to 6 inches high, bipinnate, ovato-lanceolate; pinnae of 3 to 6 pinnules  $\frac{1}{2}$  to  $1\frac{1}{2}$  inch long; pinnules cuneate or irregularly transverse-oblong, the somewhat larger terminal ones cuneate and divided into two or three shallow lobes, the margin erose, all shortly pedicellate, the pedicels hairlike, not articulated with the pinnule but showing at their apex a short y-shaped ebonous furcation which passes into the flabellate venation; sori various, two or three on the smaller pinnules short and roundish or longer and sublunate, situated at the apex of the shallow lobes; indusium entire; caudex thin, shortly creeping with criniform scales; stipes and rachis ebonous, smooth."

This is the common fern of the islands. It grows everywhere, on exposed rock surfaces that line the roadsides, on garden walls and sometimes but not often in soil. Moore's description should be modified by making the size 3 to 8 inches, the fronds bi-tripinnate and the sori long and broad in comparison with the size of

pinnules, of which they nearly cover the entire upper edge. The indusium also is not entire, but especially when young is eroded similar to the edges of the pinnules.

ADIANTUM BELLUM WALSINGENSE var. nov.

Rhizome stout, somewhat woody, repent, sending roots into the crevices of rocks: stipes 5-9 in. long, dark ebonous, shining, furrowed and at base flattened, with a few linear light brown scales; rachis conform, smooth; frond 9-12 in. long, 5-7 in. wide, tri-quadrifid; pinnae 3-6 in. long, lower opposite, upper alternate, segments  $\frac{3}{8}$ - $\frac{1}{2}$  in. long,  $\frac{1}{4}$  in. wide, sometimes cuneate, sometimes almost dimidiate, more often the latter with lower edge straight and entire, upper and outer edge with 2-3 large lobes; sinuses shallow, generally an upper and a side lobe, edges of barren pinnules finely eroded with a vein running into each tooth, venation flabellate, very distinct, texture thin, herbaceous: sori straight whether long or short, when only one sorus generally on side lobe; indusium broad and finely eroded like edges of pinnules.

This variety is much larger than the species. *A. bellum* as a rule is very fully fruited even on the smallest fronds. *A. Walsingense*, on the contrary, fruits sparingly in comparison with the large number of pinnules, which are generally two-lobed, having an upper and a side lobe. The variety shows a preference for bearing only one sorus which in that case is situated on the side lobe, thus giving the pinnules a one-sided appearance and easily distinguishing the variety.

PTERIS LONGIFOLIA L.

Neither Lefroy nor Hemsley gives this species as native or naturalized in Bermuda, but it is the one species which Reade adds to the list. It is met with quite frequently about the city of Hamilton, growing in the crevices of walls or wherever the wind may have lodged a few spores. The species is well established and is likely to increase rather than diminish.

PTERIS HETEROPHYLLA L.

This fern is found in several of the open caves and on the cliffs of the Walsingham tract. Its local name is "parsley fern," and it has been gathered so much for decoration that it is becoming

scarce except in the more inaccessible places. It seems difficult to find it in fruit, but in favorable locations the fronds attain a wonderful size, being sometimes nearly 3 feet in length, when the normal size elsewhere is only 6-12 inches. It is a West Indian and Brazilian species.

PTERIS AQUILINA CAUDATA L.

While this species is abundant in the marshes, it is peculiar in its mode of growth. In Devonshire marsh, where it grows most luxuriantly, it may frequently be seen 10-12 feet high. It seems ambitious to overtop everything near it; so it pushes up through the *Baccharis* bushes and all other undershrubs and ripples over them in shining waves of green, forming one of the most beautiful sights in the island. The fronds are hard, glossy and coriaceous, showing its siliceous character very distinctly. The farmers living in the vicinity go into the marshes and cut quantities of *Pteris* and *Osmunda* as bedding for their animals.

WOODWARDIA VIRGINICA Smith.

Governor Lefroy states that this fern is found only in Pembroke marsh and is not very abundant there. I found it quite plentiful on the north side of Devonshire marsh, where, in its young and unfruited stages it was liable to be confounded with *Osmunda cinnamomea* unless one took pains to notice its different mode of growth, standing in shade where it was sure to get plenty of water, and never with roots raised above the surrounding soil.

ASPLENIUM DENTATUM L.

Frequent on rocks in Walsingham district, covering surfaces 3 or 4 feet square, and sometimes producing fronds 4 to 5 inches long.

ASPLENIUM TRICHOMANES MAJUS Mett.

This fern, which is quite common in Bermuda is nearly identical with the form figured and described by Hooker & Greville in "Icones Filicum" as *Asplenium anceps* Solander, but afterward placed by Hooker in his "Species Filicum" as var. *majus* of *A. Trichomanes*. It is the same form that is found in Madeira and the Azores. To the casual observer it looks quite distinct from

the European and North American forms of *A. Trichomanes*, but comparison with a considerable number of specimens shows that the two forms gradually shade into each other. In Bermuda the fronds often measure 12 to 15 inches in length and are fully one inch wide. A peculiar feature of the plant in its native condition is that the pinnae rise like a series of numerous shelves one above another, instead of lying in the same plane with the rachis as in the majority of ferns. The fronds also grow upright, whereas in *A. Trichomanes* proper they spread out more in the form of a rosette.

ASPLENUM MYRIOPHYLLUM Presl.

Lefroy says that this is "The rarest of Bermuda ferns and is only found about the Church cave." Hemsley quotes Paynter's Vale as a locality, but I could not find it there, although I had a guide who was thoroughly familiar with that part of the island and took me to every spot where ferns were likely to be found. I obtained it at the Church cave, but it is very scarce there and liable to extinction. It exactly agrees with the Jamaica and Florida forms.

ASPLENUM LAFFANIANUM Baker.

This is another of the endemic species of Bermuda. Governor Lefroy supposed it to be a form of *A. crenulatum* Baker, and published it as such. A plant was sent to Kew for cultivation by Governor Laffan, and proving to be entirely new it was dedicated to him. This also has come to be a very rare fern in the islands. The only specimen I possess came from a plant in the fernery of Mrs. William Bluck, Hamilton, which she obtained at the Church cave some years ago. Mr. and Mrs. Bluck accompanied me to that locality, hoping that we might procure a few specimens; but we were not successful, nor was I able to find it on a later visit to the same cave. Lefroy said it was "found chiefly in the Walsingham tract, and is not very common." Mr. Baker puts it "near *A. crenulatum*," but it seems to come nearer *A. Mildei* Kuhn which was found in the Andes of Equador by Jameson.

DRYOPTERIS ACULEATA (L.) Kuntze.

Neither Lefroy nor Reade mentions this species. Hemsley gives it as growing at "the caves," but without special locality.

Of course he had not visited the islands, but was working on specimens ostensibly collected there. The species is so common and so well known in Europe that there could be no question of error in its determination. The only suggestion might be that, as the Challenger collections were obtained from a large number of islands in different parts of the world, a few fronds of this common fern might by accident have found their way into a collection where they did not belong. I saw nothing of it in Bermuda, but it may be a species that has disappeared from those islands, and being in the Kew collection it must stand as a Bermuda species, at least of a former time.

DRYOPTERIS CAPENSIS (Willd.) Gilbert.

This noble species, which is denominated the "ten-days fern" by Bermudians, because it will keep green ten days after it is cut, grows in the Devonshire marsh, but, as Lefroy says, "it is in danger of extermination, not being abundant." He transferred some plants to Pembroke marsh, but they do not seem to have become established. I found one plant (or "tree," as they call all single plants in Bermuda) of it under a ledge at Paynter's Vale, but that was the only other locality where it was seen.

DRYOPTERIS AMPLA (Mett.) Gilbert.

Mr. Hemsley cites Paynter's Vale for this fern. Governor Lefroy says it is "common by roadsides." There is no reason to doubt that the species grows or has grown in Bermuda, but it is doubtful if it was ever "common." Had it been so I must have seen some trace of it. Most of the species of ferns are in their best estate in March and April, but this species may appear later in the season, which would account for my not finding it. It belongs especially to the West Indies and South America.

DRYOPTERIS PATENS (Sw.) Kuntze.

This fern is, next to *Adiantum bellum*, the most common of any in Bermuda. It grows in both dry and moist ground, but in the marshes it attains its largest size, frequently reaching a height of 4 feet and a width of 1 ½ feet.



## DRYOPTERIS THELYPTERIS (L.) A. Gray.

Lefroy says this is found "along the north side of Pembroke marsh and not elsewhere," but I found it in a small marsh on the north side of Hamilton, where it grows rather sparingly among dog-bush and *Rhyncospora stellata*.

## DRYOPTERIS MOLLIS (Desv.) Kuntze.

Although this fern is given by Hemsley, he tells us that there is no specimen of it in the Kew herbarium from Bermuda. Lefroy states that he planted it out, but does not include it in his list, from which it is to be inferred that the species did not become established. If Hemsley had no specimen of it from Bermuda, it seems possible that he may have accepted Lefroy's effort to naturalize it as an accomplished fact and reported it in accordance therewith. Reade gives it, probably on the same authority, or he might easily have mistaken a specimen of *D. Bermudiana* or even of *D. patens* for *D. mollis*. At all events, it does not seem probable that the species grows in Bermuda now.

## DRYOPTERIS VILLOSA (Sw.) Kuntze.

This fern is said by Lefroy to be pretty abundant and to grow in dry places. I found it plentiful in a long "cave" south of the Church cave and also in Trott's cave; also growing on the face of the cliff at Lovers' Nook, Paynter's Vale. The plants were large and apparently very fine, but it was difficult to select fronds that were not ragged or imperfect, although the fern was just in its prime. In fact, this was true of several of the larger ferns, but it may have been caused by the uncommonly dry weather of the month of March.

## DRYOPTERIS BERMUDIANA (Baker) Gilbert.

As this is one of the endemic species of Bermuda, and as Mr. Baker's short description of it is in Latin, I will give one in English, drawn from my own specimens.

Caudex thick, shortly creeping, producing a mass of dark brown roots chaffy at the crown with lanceolate long-pointed brown scales  $\frac{1}{4}$  in. long; stipes about 6 in. long with same scales at base, finely pilose; rachis stramineous like stipes and densely pilose: frond 10-16 in. long, 3-6 in. wide, pinnate, pinnae  $1\frac{1}{2}$ -3 in. long,

$\frac{1}{2}$ –1 in. wide with very short petioles, lower pinnae variable, usually slightly reduced but sometimes largest, cut half way to the midrib, very blunt, point entire, dark green on upper side and somewhat canescent, paler on under side: segments uneven in length, blunt, close, entire, basal segments on one or both sides enlarged, texture subcoriaceous: veins beneath pilose, regularly pinnate, 5–7-jugate, lowest veinlets uniting and sending a vein to the sinus as in *Eu-Nephrodium*, simple in smaller specimens and in upper half of frond, but in larger and more mature specimens forked from the middle on inner half of pinnae often uniting at the edge and forming a pentagonal areole, thus bringing the species into the *Pleocnemia* section: sori small, situated on middle of vein when latter is simple, and at or just above the fork on the anterior veinlet when branched; involucre small, reniform, fugacious.

Mr. Baker places this in *Eu-Nephrodium*, but the probability is that his specimens were not fully developed, although the frond figured in Voyage of H. M. S. Challenger seems to be nearly full sized. The venation of the figure, however, is quite indistinct and does not convey a correct impression of the fern. There seems to be no doubt that it belongs in *Pleocnemia*, and in that light it becomes a highly interesting form, since there is but one species of that section reported as belonging to the western hemisphere, viz., *P. dissidens* from Porto Rico, which Mettenius originally described, but which neither Hooker nor Baker had ever seen.

It should be mentioned that Governor Lefroy supposed this fern to be *Nephrodium tetragonum* Hook. and so catalogued it.

#### NEPHROLEPIS EXALTATA Schott.

Given by all authorities and common among rocks in the Walsingham district.

#### POLYPODIUM PLUMULA H.B.K.

##### *Polypodium elasticum* Rich.

Both Lefroy and Hemsley give this species under the latter name, and I found it at Paynter's Vale, the locality named for it by Hemsley. Lefroy says it is "found chiefly in the Walsingham tract and not very common." It grew very sparingly this year and the weather had been so dry that the fronds were curled so that it was difficult to make good specimens of them, thus justifying the name *elasticum*, although the older name must take preference. It is a common West Indian species.

## POLYPODIUM PECTINATUM L.

Hemsley is the only authority for this species. He gives Walsingham as a habitat, but no special locality. I did not find it, but as it is one of the common ferns of the West Indies I have no doubt it grows in Bermuda. Its superficial appearance is so much like that of *P. Plumula* that it would not be strange if Governor Lefroy mistook it for that species.

## ACROSTICHUM AUREUM L.

All the authorities give this as abundant in brackish marshes, but everybody formerly took it for granted that all the plants of this genus growing in Bermuda were of one species. In the marshes on the south shore they do not attain the great size of the plants in the Devonshire marsh, and I feel certain that the former belong to *A. aureum*, as they grow in salt or very brackish water, which is the favorite habitat of *aureum*. I did not collect it there, or make any close examination of the species at the time, supposing, like everybody else, that the plants in both localities belonged to the same species.

## ACROSTICHUM LOMARIOIDES Jenman.

This is the species recently separated by Jenman from the familiar *A. aureum*. It is characterized, he states, by "its much larger size, numerous crowded fronds, the barren and fertile being uniformly separate—all the pinnae of the one being barren and all of the other fertile—much more sessile leaflets (turned transversely with the rachis, the plane to the sky like the blades of a step-ladder), intestiniform translucent pale-colored corpuscles covering the sporangia, which give a pale pruinose color to the soriferous under surfaces." I might add that the meshes of venation are much finer and point more directly to the edge, and that the costal areoles, instead of lying lengthwise along the midrib, are generally longer the other way and point outward. The venation is raised on the under side and is more distinct than it is in *A. aureum*, looking like honey-comb, as if it were made of whitish-yellow wax, while in *A. aureum* it is of the same color as the rest of the frond, or darker.

The specimens are very stiff and difficult to press on account

of the peculiar position of the pinnae mentioned by Jenman, which makes it necessary to twist them around in order to have them lie in a plane with the rachis.

Jenman gives Bermuda as one of the habitats of this species. The Devonshire marsh, where it grows, lies in the central valley of the large center island known as "the Mainland," and is out of the reach of tide water. The plants strike every one who sees them as being magnificent in size, reaching far above the head of any man, sometimes to the height of eight or nine feet. Mr. Jenman says: "This is the plant figured in Eat. Ferns N. Am. for *A. aureum*, though the true *aureum* is also found in Florida. It (*A. lomarioides*) ranges from Florida and the Bahamas down through the West Indies and Guianas to the Brazils." This, therefore, adds another species to the ferns of our own country. Eaton figures only the fertile frond, but shows a section of a pinna with the sporangia removed, thus disclosing the venation. This is represented as running rather more oblique to the rachis than it does in *A. lomarioides*, but in other respects the figure is very good. It is taken from an Indian River specimen, where, Eaton tells us, the fronds grow very tall and have all the pinnae of the fertile frond fertile and closely appressed to the rachis; which is a correct, condensed description of *A. lomarioides*.

OSMUNDA REGALIS L.

Abundant in Pembroke and Devonshire marshes.

OSMUNDA CINNAMOMEA L.

Abundant in same localities and very luxuriant in growth.

In addition to the above named species, Governor Lefroy put at the end of his list *Blechnum occidentale* L. which, he said, "was planted out in suitable places in 1877." Neither Hemsley nor Reade seems to have had any native specimen of it, nor is there any evidence of its existence there now. It must therefore be regarded as another case of failure to become naturalized.

If we eliminate from this list the species *Dryopteris mollis*, which was evidently catalogued through some mistake, there will remain 25 species and varieties of ferns that may properly be regarded as native or naturalized in Bermuda. An analysis of

these species and of the countries where they are known to be indigenous shows that 15 belong to the West Indies, 3 to the continent of North America, 2 to Europe and 1 to the Azores ; while 4 are endemic, being the product of Bermuda alone. Thus it is evident that the presence of a great majority of the species can be accounted for by transmission on the waves or winds from comparatively nearby sources. Even the Azorean form of *Asplenium Trichomanes* may well be regarded as a development of that species resulting from insular conditions in both cases. *Adiantum Capillus-Veneris* and *Dryopteris aculeata* are really denizens of the world and liable to be found almost anywhere. There remain the four distinctive species and variety belonging to Bermuda alone ; and I leave it for the speculative botanist to determine whether these are the results of evolution, or whether they are the remains of a flora that existed in an earlier geological period when a much greater land surface existed where the Bermudas now lie, and of which they formed the central and most elevated portion.

There is a curious relation between the fern flora of Bermuda and that of Juan Fernandez. The latter is 18 miles long and 6 miles broad, with mountains 3,000 ft. high. Thus while it is not so long as Bermuda, it is so much wider that the superficial area must be somewhat greater, while the high elevation of the land affords a much greater variety of climatic conditions. Their distance from the equator is approximately the same, Bermuda being  $32^{\circ} 15'$  N. and Juan Fernandez  $33^{\circ} 37'$  S. But while Bermuda is 600 miles from the coast of North America, Juan Fernandez is only 400 miles from the coast of South America. Alfred Russell Wallace informs us that there are 24 species of ferns in Juan Fernandez and that 4 of these are "quite peculiar," by which he means that they are endemic. This lacks only one of the same number of species as are found in Bermuda, and what is still more curious, there is exactly the same number of endemic species. Mr. Wallace declares that the latter fact indicates "the remote period when Juan Fernandez first received its vegetation." If the same reasoning be applied to Bermuda, we shall be led to infer that a portion of the main island at least is of very ancient origin, and that the peculiar species are survivals rather than developments.